Northern Leopard Frog Recovery Program

Year 5 (2003)

Kris Kendell

In cooperation with:

Alberta
SUSTAINABLE RESOURCE DEVELOPMENT

Alberta Conservation Association

Shell Environmental Fund

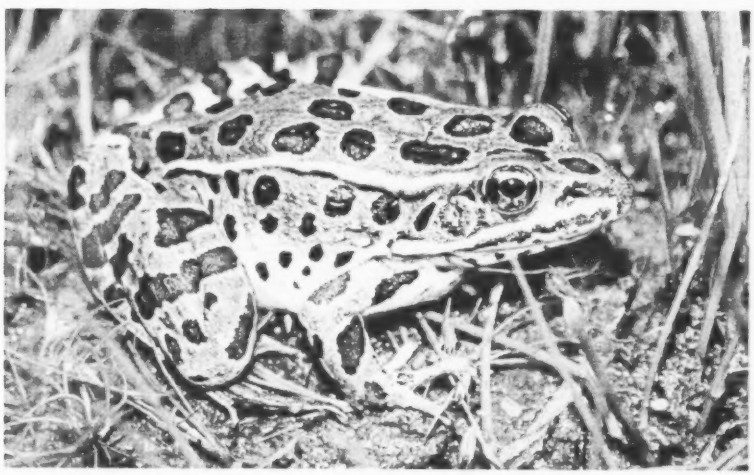
North American Waterfowl Management Plan

Friends of the Environment Foundation

104-04321/

Northern Leopard Frog Recovery Program

Year 5 (2003)



This publication may be cited as:

Kendell, K. 2004. Northern leopard frog recovery program: Year 5 (2003). Unpublished report, Alberta Conservation Association, Edmonton, AB. 14 pp.

TABLE OF CONTENTS

ACKNOWLEDGEMENTS iv
EXECUTIVE SUMMARY v
1.0 INTRODUCTION 1
2.0 STUDY AREA 2
2.1 Egg mass collection and frog release sites 2
2.2 Captive rearing site 2
3.0 METHODS 3
3.1 Captive rearing 3
3.2 Marking 3
3.3 Release (2003) 3
3.4 Frog surveys 4
3.5 Education and Outreach 4
4.0 RESULTS 4
4.1 Captive rearing 5
4.2 Frog observations 5
5.0 DISCUSSION 6
6.0 LITERATURE CITED 10
7.0 APPENDIX 12

ACKNOWLEDGEMENTS

Work completed on the northern leopard frog reintroduction project in 2003-04 was made possible through the funding and in kind support of the following associations, agencies and foundations: Alberta Conservation Association (ACA); Alberta Sustainable Resource Development (SRD) - Fish and Wildlife Division; Alberta North American Waterfowl Management Plan (NAWMP) – Ducks Unlimited Canada; TD Friends of the Environment Foundation; and the Shell Environmental Fund.

A special thanks is owed to Dawn Birn, Julie Pierce (ACA) and Callie Smith (SRD) for their assistance during the 2003-04 field season. In addition, the author would like to thank the many volunteers from the following organizations and groups for their dedication to, and interest in, the project: the ACA; Alberta SRD; the Red Deer River Naturalists; the Calgary Zoo; local landowners and the general public

Lance Engley (ACA) and Sue Cotterill (SRD) provided editorial comments for this report.

Finally, I would also like to acknowledge the Alberta SRD staff at the Raven Brood Trout Station - Rod Burns, Steve Cunningham and Craig Ladd, for their much-appreciated contribution of time, equipment and technical expertise to the project.

My sincere apologies to anyone I have neglected.

Please note that the views and opinions expressed are those of the author and do not necessarily represent the policies or positions of the Alberta Conservation Association or our funding agencies.

EXECUTIVE SUMMARY

Through the first five years of the northern leopard frog reintroduction program, nearly 12,000 leopard frogs have been captive-reared at the Raven Brood Trout Station and released into habitats within the historical range of the species. Of these 12,000 leopard frogs, approximately 7,700 frogs have been released into the upper headwaters of the Red Deer River near Caroline. Over a three-year period beginning in 2001, 2,845 frogs have been released at a site along the North Saskatchewan River near Rocky Mountain House and over a two-year period beginning in 2002, 1,310 frogs have been released at a Ducks Unlimited property near Red Deer.

Confirmed leopard frog observations in 2001, 2002 and 2003 as well as evidence of breeding activity in 2002 show some evidence of the preliminary success of the project at the Caroline release site. With the exception of two unconfirmed leopard frog observations in 2001 at the North Saskatchewan River release site, no other observations have been documented from that site. In addition, no observations of leopard frogs have been recorded at the Ducks Unlimited property.

1.0 INTRODUCTION

Once a common and widespread species throughout much of Canada, the northern leopard frog (*Rana pipiens*) has declined or vanished from much of the western portion of its range (Roberts 1987, Seburn and Seburn 1998). In Alberta, the decline resulted in a significant range contraction and reduction in population numbers leaving the leopard frog absent from much of its northern and western range (Roberts 1981). The northern leopard frog has been considered to be an "At Risk" species in Alberta since 1991. It was designated as "Threatened" under Alberta's *Wildlife Act* in 1996. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) lists the prairie population of the northern leopard frog as "Special Concern" (COSEWIC 2002).

The leopard frog has demonstrated little ability to naturally disperse back into the broader parts of its historic range because of large tracts of unsuitable habitat between existing populations. As a result, the re-establishment of leopard frogs into these former areas will be dependent on transplanting individuals from existing populations in southern Alberta. (Cottonwood Consultants 1986, Roberts 1987, Wershler 1991, Wagner 1997).

In 1998, the Alberta Fish and Wildlife Division began to explore the feasibility of reintroducing leopard frogs into formerly occupied habitats (Fisher 1999). With the information gathered, Alberta Fish and Wildlife Division and the Alberta Conservation Association initiated a reintroduction project at the Raven Brood Trout Station near Caroline, Alberta, that has been carried out since 1999.

2.0 STUDY AREA

2.1 Egg mass collection and frog release sites

The 2003 study area for the leopard frog project included egg mass collection locations in southern Alberta (near Bow City) and frog release sites in the upper headwaters of the Red Deer and the North Saskatchewan Rivers.

The first release site, called the Raven River release site, is situated near the Raven Brood Trout Station, southeast of the town of Caroline. A second release site, called the North Saskatchewan River release site is located northeast of Crimson Lake Provincial Park, near Rocky Mountain House and along the North Saskatchewan River. A third release site called the Hummer Property or Middle Wooden Lake is located south east of Red Deer on a Ducks Unlimited managed property. The Hummer Property is situated in the Ghostpine Creek drainage system, which is associated with Pine Lake.

2.2 Captive rearing site

Two large outdoor ponds at the Raven Brood Trout Station were used to rear leopard frogs from egg stage of development to young of the year frogs. The Raven Brood Trout Station is an Alberta Sustainable Resource Development owned and operated facility. As in previous years, the outdoor ponds (hereafter referred to as east and west rearing pond) at the facility offered managed access and the means to confine captive-reared juvenile leopard frogs prior to being released into the wild (see Figure 1).

Figure 1. Raven Brood Trout Station and leopard frog rearing ponds.

3.0 METHODS

3.1 Captive rearing

In 2003, four leopard frog egg masses were collected from four different ponds in southern Alberta. All ponds were in the vicinity of Bow City. More specifically, one pond was located at Circle E Ranch (Ducks Unlimited managed property); another egg collection site was located on private land along the Bow River. The remaining two ponds were near the Bow City recreation area. The four egg masses were transported individually, in 2-liter thermos', to the Raven Brood Trout Station. Each egg mass was then placed separately into a floating egg mass predator exclosure, in the east and west rearing ponds. Once the eggs hatched, the hatchling tadpoles were confined to the exclosures until they were free swimming and were then disproportionably released between the two ponds. For a more detailed description of the egg mass predator exclosures used, and care of egg masses and hatchling tadpoles see Kendell (2001).

During the captive rearing process the water levels and potential predator threats were carefully monitored and managed when needed. Metamorphosed frogs were collected soon after the first completely transformed frogs were observed on the shore of the rearing ponds in noticeable numbers. Nets and funnel traps were used to capture the frogs. Each funnel trap contained 1 inch of water so that the frogs would not desiccate and the traps were left unchecked for no more than a 24-hour period. For a complete description of the funnel traps used in 2003, see Kendell (2001).

At the end of August, water levels in the rearing ponds were reduced to allow personnel to more easily capture the remaining leopard frogs. The weight and snout-to-vent length (SVL) of every tenth frog captured for release into the wild was measured and recorded. While handling frogs during the marking stage, physical abnormalities such as missing limbs and wounds were generally noted.

3.2 Marking

Captive-reared leopard frogs were marked using a Visible Implant Elastomer (VIE) tagging system (Northwest Marine Technology, Inc. 2003). The tagging system provided an externally visible internal identification mark. The mark consisted of a fluorescent elastomer agent, that when mixed with a curing agent, cured into a pliable solid within 24 hours. Using a 3/10 hypodermic syringe, this biocompatible agent was injected into the webbing between the fourth and fifth toe of the rear foot of each young frog. To reduce the activity level of the young frogs during the marking process, they were occasionally subjected to chilled (4-6°C) spring water. In 2003, all frogs were marked with purple elastomer.

3.3 Release (2003)

Captive reared frogs were transported to release sites using 70-litre tote bins. Moist vegetation was added to each bin and the bins were fashioned with air holes for ventilation. Frogs were released directly into suitable potential breeding habitat at their respective release site.

Each site possessed the availability of over-wintering, breeding and summer habitat necessary for the life cycle of the leopard frog. Depending on the site, dispersal opportunities were possible into the Red Deer or North Saskatchewan River drainage.

3.4 Frog surveys

Leopard frog surveys began in mid May 2003 for potential surviving leopard frogs at all three sites. Early spring surveys focused on favourable leopard frog breeding habitat and for evidence of breeding (i.e., egg masses). Surveys continued through June, July and August at all three sites.

In total, approximately 84 person hours were spent surveying for leopard frogs in the month of June, at all three-release sites. On 16 July, 12 individuals spent approximately four hours surveying for leopard frogs at the Caroline release site. Five individuals surveyed the Ducks Unlimited property again on 22 July for approximately four hours. Six individuals surveyed the Rocky Mountain House release site 30 July. Additional formal surveys were undertaken on 5 and 6 August at the Rocky Mountain House and Ducks Unlimited property site, respectively. Many informal surveys were undertaken at the Caroline release site throughout the summer.

3.5 Education and Outreach

Public presentations and interpretative events were conducted at the Raven Brood Trout Station featuring the program itself as well as topics of amphibian ecology and conservation.

4.0 RESULTS

To date nearly 12,000 captive-reared leopard frogs have been released into designated release sites near Caroline, Rocky Mountain House and Red Deer, Alberta. Confirmed leopard frog observations and evidence of breeding activity indicate preliminary success of the project at the initial release site near Caroline, Alberta (Kendell 2003).

As in previous years, public involvement and education were important components of the summer captive-rearing program at the Raven Brood Trout Station. More than 70 volunteers were involved with the project, helping with the frog surveys and the collection, marking and releasing of captive reared frogs in August. Many of the volunteers, naturalist groups and school groups were given formal and informal presentations regarding the project and Alberta's reptiles and amphibians.

Volunteers included members of the general public and individuals from the following organizations: Red Deer River Naturalist, The Calgary Zoo, ACA and SRD. In addition, the Red Deer Advocate newspaper featured a front-page story on the project.

4.1 Captive rearing

In total, 7,380 tadpoles were counted from the four egg masses collected in 2003. The overall productivity (percent of tadpoles that survived to metamorphosis) in the two rearing ponds in 2003 was slightly higher then the previous year (Table 1). Of the 7,380 living tadpoles introduced into the two ponds, 2,491 metamorphs were captured, marked and released, representing a survival rate of approximately 34%.

Table 1. Percent of tadpoles that survived to metamorphosis during each field season from 1999 to 2003.

Year	No. of egg masses	No. of tadpoles hatched	No. of metamorphs	% Survival through tadpole metamorphosis
1999	3	8,292	1,430	17 %
2000	4	6,692	1,477	22 %
2001	6	21,036	2,983	14 %
2002	4	12,676	4,191	33 %
2003	4	7,380	2,491	34%

The release of frogs commenced on 8 August with frogs collected shortly after complete metamorphosis. Ninety-two percent of the frogs reared in 2003 were collected and released at designated sites by 14 August. The remaining captive reared frogs were collected and released by 26 August. All 2,491 frogs reared in 2003 were distributed and released at the three predetermined release sites: Raven River (n=1,196), North Saskatchewan River (n=795) and Ducks Unlimited Hummer Property (n=500).

4.2 Frog observations

Two female leopard frogs released in 2000 (marked with orange and green elastomer on frogs left hind foot) were captured. The first frog was captured on 18 June and the second frog was captured on 8 August. Both frogs were observed and captured within the rearing ponds at the Raven Brood Trout Station. Each frog was subsequently released into a nearby pond upon capture.

Three unconfirmed sightings of leopard frogs were recorded in 2003 – all associated with the Caroline release site. In one incident, the observers failed to get a visual sighting on the frog, but based on distance covered as the frog leaped into the water and the size of splash, all observers were confident it was a leopard frog. Two separate local landowners reported observing leopard frogs on their property upstream from the Raven Brood Trout Station, along the Beaver Creek. Surveys along Beaver Creek, further upstream from the station, were undertaken in 2003-04 but no leopard frogs were observed.

5.0 DISCUSSION

Over the last 40 years, northern leopard frog populations have declined dramatically over much of the species' range in North America. In Alberta, these declines were accompanied by changes in distribution. Since 1990, considerable effort has been expended trying to locate leopard frogs in Alberta. The results of a recent inventory for the species in 2000-01 indicated that the leopard frog occurs in abundance at only a few isolated and fragmented sites, primarily along the lower reaches of a few major drainages in southern Alberta (Kendell 2002c). Little studied, the status of leopard frog populations in extreme north-eastern Alberta is largely unknown.

The northern leopard frog has been considered to be an "At Risk" species in Alberta since 1991. It was formally designated as "Threatened" under Alberta's *Wildlife Act* in 1997. Recent re-evaluation/recommendation of the Endangered Species Conservation Committee (ESCC), as "Threatened", has been sent to the Minister of Alberta Sustainable Resource Development. Initiation of formal recovery planning will begin in 2004-05 with the formation of a Provincial Recovery Team.

A critical review of the core program activities and areas is currently underway by the program coordinator and should be further addressed in 2004-05 by a newly formed leopard frog Recovery Team. Under this review, new partnerships and funding sources will be explored, and program components will be studied, expanded or modified where needed to increase the scientific basis of the program and its effectiveness. The author recommends that the Recovery Team address emerging genetic questions and concerns of leopard frog populations in the province, undertake an evaluation of the current reintroduction program, and incorporate stewardship activities to ensure existing populations remain viable.

These approved and endorsed objectives should include the release of captive reared leopard frogs at designated release sites. Release stock would be obtained from leopard frog egg masses collected from source populations and reared through metamorphosis at the Raven Brood Trout Station. However, release stock could also be obtained in other ways, such as through a leopard frog captive breeding program at the Calgary Zoo or possibly through individuals transplanted from secure populations in other jurisdictions.

To date, approximately 12,000 captive-reared leopard frogs have been released at the three selected release sites in the Red Deer and upper North Saskatchewan River drainage. The observation of at least 24 leopard frogs, one egg mass and breeding activity (calling), between 2000 and 2003, indicate preliminary success at the Raven River release site near Caroline.

The reintroduction of the leopard frog into its historic range has helped reduce its restricted breeding distribution and sensitivity to environmental changes and stressors that may affect localized populations. Today, remaining leopard frog populations primarily occur in southern portions of the province, of which many are isolated and vulnerable to disturbance, disease and natural disasters. The long-term benefits of the program include increased biodiversity at release sites, the creation of a more stable and widespread leopard frog distribution in Alberta, and the contribution of knowledge to other biologists in other jurisdictions undertaking conservation oriented amphibian reintroduction programs.

Other objectives should involve better understanding the genetic variation in leopard frog populations throughout Alberta to address whether or not populations within Alberta are genetically distinct based on geographical location. Data collected would help the Recovery Team better understand the genetic diversity of populations, assist in the selection of source populations to draw stock for captive rearing and in the determination of release sites.

The Provincial Recovery Team should address the genetic diversity of leopard frogs in Alberta. Concerns have been raised that gene flow between genetically distant populations, such as those at the interior of a species' range and those on the periphery, would actually increase the probability of extinction in augmented populations. Important considerations must be given to the genetic makeup of reintroduced individuals to guard against offspring being maladapted to the local environment.

Through a newly formed Provincial Recovery Team, it is also recommended that a broad landscape stewardship approach be delivered to ensure that land use practices maintain or improve habitat that is critical to the survival of the leopard frog.

Although little studied, the decline of the leopard frog in Alberta does not appear to be part of a regular cycle (Wagner 1997). Habitat loss is believed to be one of the causes of northern leopard frog decline in several northwestern states (Koch et al. 1994) and in some areas of Alberta populations have undoubtedly been affected by it as well. Leopard frogs rely on the juxtaposition of a variety of habitat types to meet their annual life history requirements. For example, the leopard frog requires three distinct habitat types: a breeding pond, upland foraging habitat and a suitable overwintering waterbody. This dependency for a mosaic of habitat types makes the leopard frog particularly vulnerable to the alteration, fragmentation or loss of key habitat. Within the core of the leopard frog's current range, habitat degradation and loss can be the result of mismanaged livestock grazing. Livestock are considered to be a significant threat to frog populations in southern Alberta (Wagner 1997). Water management practices have also been identified as a possible limiting factor for leopard frogs in Alberta by reducing wetland vegetation and/or water levels affecting both the quality and availability of cover vegetation and breeding and overwintering habitat (Wagner 1997).

The author recommends that the Recovery Team undertake an assessment of habitat at extant leopard frog sites to help to ensure that land use practices that support populations are encouraged, thus maintaining or improving habitat that is critical to the survival of the leopard frog. This assessment of habitat could be carried out at known major leopard frog sites identified in the 2000-2001 leopard frog inventory (Kendell 2002c). Efforts should also be taken to sample sites located in northeastern Alberta. Selected leopard frog sites in the South Saskatchewan and Milk River drainage basins should be investigated.

Habitat, landscape features as well as potential threats to the sties should be identified and recorded at each occupied site investigated. This information would be used to determine if habitat "improvements" are necessary or required at those sites: e.g., mitigation, restoration, land management improvements, fencing, controlled grazing, etc. Many of these mentioned habitat improvement initiatives could be integrated with existing stewardship programs such as the Nature Conservancy of Canada and North American Waterfowl Management Plan.

Data collected at sites investigated could also be used to create a model to identify criteria to separate high-quality reintroduction habitat from similar habitat of lesser value to leopard frogs. Under this scenario, within the South Saskatchewan and Milk River drainages, sites should be selected amongst the four sub-basins: Bow River, South Saskatchewan River, Oldman River and Milk River. A number of confirmed historical leopard frog sites should also be investigated within the mentioned sub-basins for comparison of habitat with the occupied sites.

Ultimately, this information may improve the selection process for release sites with regards to the established provincial leopard frog reintroduction program, supporting the recovery of the species. Also, any potential habitat improvements could benefit a variety of species that share this ever-diminishing quality upland and riparian habitat in southern Alberta.

Finally, in 2003, the Alberta Conservation Association expanded their partnership with the Calgary Zoo to include a scientific research project, which may have future management implications on the reintroduction program. This expanded partnership was in addition to the in kind volunteer support the zoo historically provided from the involvement of its staff and volunteers during the marking and releasing of captive reared frogs at the Raven Brood Trout Station.

During the 2003 field season, in consultation with the Alberta Conservation Association, the Calgary Zoo initiated a study which involved the following objectives: (1) to determine the density of northern leopard frogs in the study area after release (2) to determine the habitat selection and relative abundance of northern leopard frogs post-release, (3) to determine post-release movement rates and the effect of frog size and weight on dispersal distance, (4) to determine the exposure of northern leopard frogs to potential naturally occurring chytrid fungus before release, one month after release and one year after release.

To facilitate work completed in 2003, an optimal pitfall trap design (i.e., depth and width) to capture leopard frogs was researched and tested. Ten drift fencing arrays in a Y-design (each with a 5 m long arm) were set-up at random locations throughout the Raven Brood Trout Station quarter section. Three straight-line fences (each 10 m long) were also set up within the study area along major waterbodies. In total, 49 pitfall traps were in operation between 12 August and 26 September, and were located in various habitat types. Samples to be tested for chytrid fungus were taken from approximately 50 leopard frogs (pre-release) and a number of wood frogs naturally occurring in the study area. Samples have not yet been analyzed. In addition to a small number of leopard frogs released that season (~8), wood frogs and boreal toads were also captured in the traps. Finally, a transect survey was conducted every afternoon along a major drainage in the study area. This survey effort was in addition to the formal and informal surveys conducted by ACA staff, mentioned above.

Since 2000, the author has recommended that the idea of a leopard frog captive-breeding program, involving the Calgary Zoo, be investigated. The primary goal of such a program would be to maintain a genetically viable breeding population of leopard frogs over the long-term and that could be used to produce leopard frogs for the purpose of reintroduction. A number of areas of research would arise from such a program at the Calgary Zoo and could include: hibernation

(what role air and water temperature, photoperiod and other water quality conditions have on hibernation), reproduction (how weight loss and water quality conditions during hibernation and weight gain prior to hibernation affect reproductive success) and the evaluation and role genetics play on the survival rate during hibernation and reproductive success. Existing education and outreach programs at the Calgary Zoo would also help raise public awareness of the leopard frog. Regardless of the level of the zoo's involvement, public outreach and education should continue to be a fundamental part of the recovery program.

In order to incorporate a variety of conservation initiatives and management strategies into the leopard frog recovery program, it is recommended that the primary goal of the recovery program be broadened and objectives, such as those stated above, be considered by the Provincial Recovery Team.

Finally, this recovery program, under the above suggestions, would addresses the following issues: 1) Prevent the leopard frog from becoming extirpated or extinct; 2) Undertake recovery efforts (i.e., reintroducing individuals into localities in which they have been extirpated); 3) Increase public awareness of the needs of the leopard frog; 4) Engage citizens in recovery and conservation actions (stewardship).

6.0 LITERATURE CITED

Alberta Environmental Protection. 1996. The Wildlife Act. Alberta Environmental Protection, Natural Resources Service. 212 pp.

Biodiversity Species Observation Database (BSOD). 2000. Natural Resources Service / Alberta Conservation Association, Edmonton, Alberta.

COSEWIC 2002. Canadian species at risk, May 2002. Committee on the Status of Endangered Wildlife in Canada, Ottawa, ON. 32 pp.

Cottonwood Consultants Ltd. 1986. An overview of reptiles and amphibians in Alberta's grassland and parkland natural regions. Prepared for World Wildlife Fund Canada. (Wild West Program), Toronto, ON. 63+ pp.

Fisher, C. 1999. Feasibility of northern leopard frog translocation in Alberta: a review of physiological, ecological, methodological requirements for successful repatriations and results from field investigation. Alberta Environment, Fisheries and Wildlife Management Division, Edmonton, AB. 35 pp.

Kendell, K. 2001. Northern leopard frog reintroduction: year 2 (2000). Alberta Sustainable Resource Development, Fish and Wildlife Service, Alberta Species at Risk Report No. 13, Edmonton, AB. 43 pp.

Kendell, K. 2002a. Northern leopard frog reintroduction: year 3 (2001). Alberta Sustainable Resource Development, Fish and Wildlife Division, Alberta Species at Risk Report No. 42, Edmonton, AB. 45 pp.

Kendell, K. 2002b. Survey protocol for the northern leopard frog. Alberta Sustainable Resource Development, Fish and Wildlife Division, Alberta Species at Risk Report No. 43, Edmonton, AB. 30 pp.

Kendell, K. 2002c. Alberta inventory for the northern leopard frog (2000/2001). Alberta Sustainable Resource Development, Fish and Wildlife Division, Alberta Species at Risk Report No. 44, Edmonton, AB. 29 pp.

Kendell, K. 2003. Northern leopard frog reintroduction: year 4 (2002). Alberta Sustainable Resource Development, Fish and Wildlife Division, Alberta Species at Risk Report No. 78, Edmonton, AB. 15 pp.

Koch, E. G., G. Williams, C. R. Peterson, and P. S. Corn. 1996. A summary of the Conference on declining and sensitive amphibians in the Rocky Mountains and Pacific Northwest. Idaho Herpetological Society and U.S. Fish and Wildlife Service, Snake River Basin Office Report, Boise, ID.

Roberts, W. E. 1981. What happened to the leopard frog? *Alta. Nat.* 11 1-4.

Roberts, W. E. 1987. The Northern Leopard Frog endangered in Alberta. Pp. 137-138 in Endangered species in the prairie provinces (G. L. Holroyd, W. B. McGillivray, P. H. Stepney, D. M. Ealey, G. C. Trottier, and K. E. Eberhart, eds.). Provincial Museum of Alberta Nat. Hist. Occ. Pap. No. 9. Edmonton, Alberta. 367 pp.

Roberts, W. E. 1994. Amphibian decline? Maybe, maybe not. Env. Net. News. Jan/Feb 11-13.

Seburn, C. N. L., and D. Seburn. 1998. Status Report: northern leopard frog *Rana pipiens* (western population). Committee on the Status of Endangered Wildlife in Canada. Unpul. Report.

Wagner, G. 1997. Status of the Northern Leopard Frog (*Rana pipiens*) in Alberta. Alberta Environmental Protection, Wildlife Management Division, Wildlife Status Report No. 9, Edmonton, AB. 46 pp.

Wershler, C. R. 1991. Status of the northern leopard frog in Alberta - 1990. Unpublished report by Sweetgrass Consultants Ltd. for World Wildlife Fund Canada (Prairie for Tomorrow) and Alberta Forestry, Lands and Wildlife, Edmonton, AB. 81 pp.

7.0 APPENDIX

Confirmed leopard frog observation 2001-2003

Date	No. Frogs Obs.	Location	Notes
19 June 2001	1	Raven Brood Trout Station, east rearing pond.	Male. Observed in east rearing pond at Raven Brood Trout Station, believed to be captive reared and released in 2000. This frog was also heard calling on 2 August 2001 from the same pond. This calling activity was not associated with breeding activity. The frog was relocated out of the rearing pond on 24 August 2001. No elastomer mark. Very first leopard frog to be observed in the Caroline area in nearly 50 years and first confirmed over-wintering survivor of the reintroduction project. Between 19 June and 1 August 2001 (upon second capture), weight and SVL increased from 11g to 33g and 46 mm to 73 mm, respectively.
19 June 2001	1	Small pond near Raven River north of Raven Brood Trout Station.	Unknown sex. Observed in small pond near the Raven River north of Raven Brood Trout Station. Observed a second time on 12 July 2001. Marked with orange elastomer on left hind foot. Between 19 June and 12 July 2001 (second capture), weight and SVL increased from 7.5g to 14.5g and 42mm to 50mm, respectively.
19 June 2001	1	Small pond near Raven River north of Raven Brood Trout Station.	Unknown sex. Frog observed a second time on 12 July in same location.
25 June 2001	1	Raven Brood Trout Station, east rearing pond.	Female. Frog first observed in east rearing pond at Raven Brood Trout Station on 25 June 2001. Captured on 25 July 2001. Marked with green elastomer on left hind foot. Weight and SVL increased from 17g to 36g and 52mm to 64mm, respectively, between 25 July and 31 August 2001.
12 July 2001	5	Oxbows along the Raven River north of the Raven Brood Trout Station.	Orange elastomer in left hind foot of two frogs. Frog released in 2000.

Confirmed leopard frog observation 2001-2003 (cont.)

Date	No. Frogs Obs.	Location	Notes
7 August 2001	1	Small pond near Raven River north of Raven Brood Trout Station.	Frog observed.
10 August 2001	1	Raven Brood Trout Station, east rearing pond.	Male. No elastomer mark obvious. Frog first observed on 10 August 2001. Suspected of calling from cooling pond on 2 August 2001. Captured on 13 August and 24 August 2001.
14 August 2001	2	Oxbows along the Raven River and along the Raven River north of the Raven Brood Trout Station.	One frog identified as a female. Both had yellow elastomer in left hind foot. Frogs released in 2000.
27-29 August 2002	3-4	Pond next to the Raven Brood Trout Station.	Three to four male leopard frog heard calling.
19 June 2002	Egg mass	Pond next to the Raven Brood Trout Station.	Confirmed leopard frog egg mass about the size of a tennis ball.
24 June 2002	1	Oxbows along the Raven River north of the Raven Brood Trout Station.	Female. Blue elastomer mark on left hind foot. Frog released in 2001.
2 July 2002	1	Oxbows along the Raven River north of the Raven Brood Trout Station.	Frog observed.
10 July 2002	1	Oxbows along the Raven River north of the Raven Brood Trout Station.	Female. Blue elastomer mark on left hind foot. Frog released in 2001.
7 August 2002	1	Oxbows along the Raven River north of the Raven Brood Trout Station.	Female. Orange elastomer in left hind foot of two frogs. Frog released in 2000.

Confirmed leopard frog observation 2001-2003 (cont.)

Date	No. Frogs Obs.	Location	Notes
20 August 2002	1	Oxbows along the Raven River north of the Raven Brood Trout Station.	YOY, unknown sex. Unknown if this frog was procured in nature or was a captive reared individual.
21 August 2002	1	Oxbows along the Raven River north of the Raven Brood Trout Station.	Male. Green elastomer in left hind foot of two frogs. Frog released in 2000.
18 June 2003	1	Raven Brood Trout Station, east rearing pond.	Captured in rearing pond at the Raven Brood Trout Station. Marked orange on left hind foot indicating captive reared and released in 2000.
8 August 2003	1	Raven Brood Trout Station, west rearing pond.	Captured in rearing pond at the Raven Brood Trout Station. Marked green on left hind foot indicating captive reared and released in 2000.